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(71) Applicant  
Alastair Neil Mackenzie  
6 Marlborough Avenue, Marske-By-Sea, Redcar,  
Cleveland, TS11 6AS, United Kingdom

(72) Inventor  
Alastair Neil Mackenzie

(74) Agent and/or Address for Service  
Urquhart-Dykes & Lord  
Cardiff Business Technology Centre,  
Senghennydd Road, Cardiff, CF2 4AY, United Kingdom

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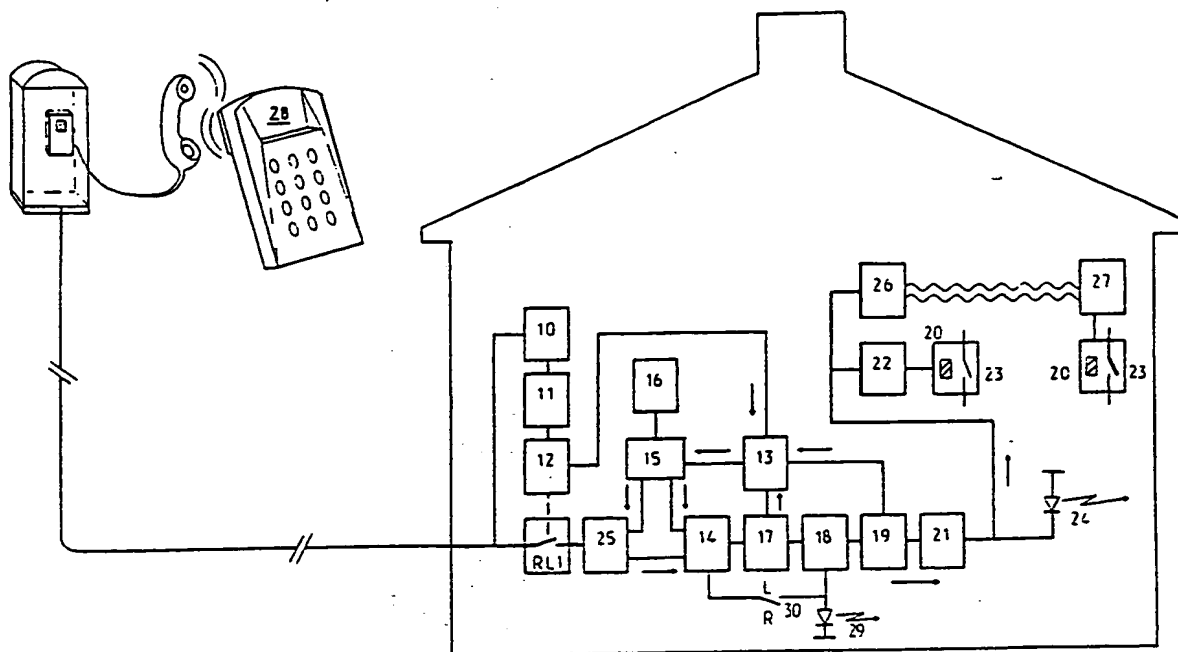
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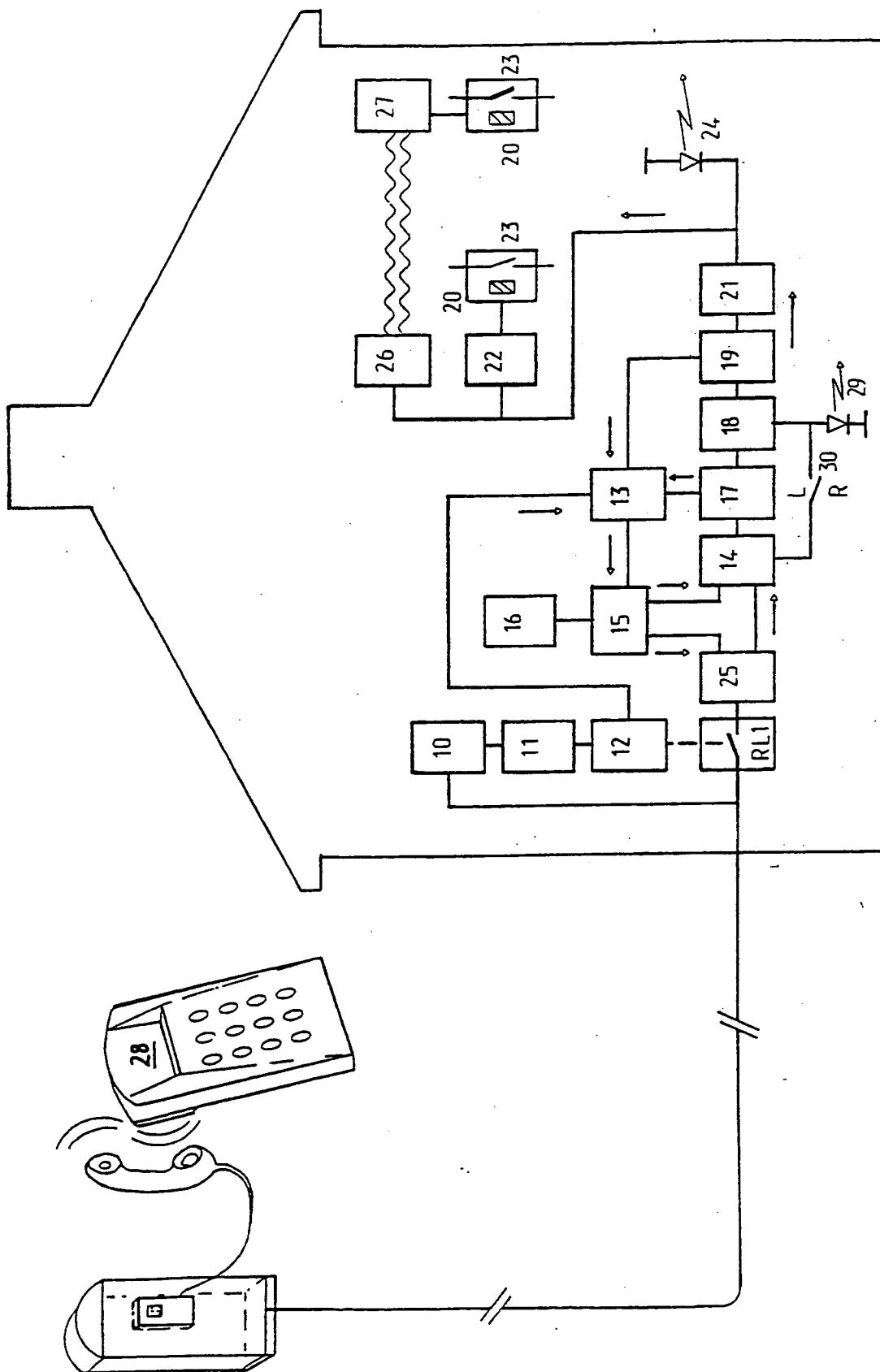
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(54) Controlling home appliances by audio tones transmitted over a telephone line or generated locally

(57) A control system for controlling one or more electrical appliances e.g. in the home, either remotely over the telephone network or locally via a keypad on the control panel of the system. The system is connected to a telephone line and picks up at RLI when a ringing tone is detected at 10. A decoder 18 responds to DTMF audio tones transmitted over the telephone line after picking up, or to such tones locally generated by the control panel keypad 16, to control the appliances via switches 23. A security code must be transmitted.



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## CONTROL SYSTEM

This invention relates to a control system for controlling electrical appliances over the telephone network.

In accordance with this invention, there is provided a control system for controlling one or more electrical appliances, comprising means for connection to a telephone line and arranged to respond when the appropriate telephone number is called, and control means for then responding to audio tones received over the telephone line to control the electrical appliances remotely, the control means also being responsive to audio tones generated by use of a keypad of the control system to control the electrical appliances locally.

The control system is particularly useful for switching on or off electrical appliances, including electrical power supplies, and may control on/off switches additional to or replacing the on/off switches of the appliances themselves.

The control system thus enables electrical appliances to be switched on or off from any remote location, by the user calling the appropriate telephone number from any telephone connected to the public telephone network, and then transmitting selected tones to achieve the required control operation.

The control system may be used for example in the home and for example for the remote switching on and off of central heating systems, air conditioning systems, internal and external lights, greenhouse heating, electric blankets or any other appliance which is controlled by switching on or off its electrical supply.

The control system enables the controlled appliances to be switched on or off locally, in addition to enabling them to be switched on or off remotely. Therefore the control system includes a keypad for controlling the appliances locally by keying in selected codes to effect the required switching operations. Preferably audio tones generated by the

keypad are decoded by the same decoder which responds to the audio tones transmitted over the telephone network when the control system is being operated remotely. Preferably these audio tones are dual tone multifrequency (DTMF) signals conventionally in use on the public telephone system: the user may have a hand held DTMF transmitter unit which he can hold to the mouthpiece of a remote telephone from which he calls and then key in the appropriate code on this unit. Instead, if the remote telephone being used is of the multi-frequency type, then once connected the keypad of the telephone itself may be used to key-in the required code, the telephone automatically transmitting the corresponding audio tones from its DTMF generator.

Then for local control, the keypad of the control system itself generates corresponding DTMF signals. The control system has two modes, local mode and remote mode, and when in remote mode can only be operated by calling in from a remote telephone, and when in local mode it is unresponsive to any incoming call on the telephone line.

In a preferred embodiment the control system will still operate in remote mode even if an answerphone is connected in parallel with it. Thus, the control system detects a ringing signal but only picks up after a time delay (preferably adjustable) sufficient to ensure that the answerphone is given time to pick up first. Thus any caller wishing to leave a message on the answerphone can do so in the usual manner.

When the control system is connected in parallel with or in place of a normal telephone a caller will hear the usual ringing tones for the predetermined time delay prior to the control system picking up. Preferably then the control system generates a tone for a short duration e.g., several seconds to indicate that it has answered, and then it waits for instructions.

Preferably the control system, when in remote mode, then requires the user to enter a security code, e.g. of

four digits. Preferably a reset function may be used to permit subsequent attempts e.g. if the user keys in his security code incorrectly. If no correct security code is received by the control system within a predetermined time, preferably it goes off line silently. However if a correct security code is received preferably the control system then acknowledges this by transmitting a distinctive tone. Preferably now a predetermined time period is allowed for effecting control operations. Preferably as each tone is transmitted by the user, the control system responds with an acknowledgement tone: preferably this tone is generated only upon release of the key by the user, so that the user will not miss the acknowledgement tone by pressing the key too long.

In effecting a control function in local or remote modes, the user will need to select the appliance to be controlled and then give a "switch on" or "switch off" command. For example, the channel for the appliance concerned may be selected by entering the channel number, e.g. 1, and then # to switch it on.

Preferably after entering security code the control system enables the user to determine the status of each channel remotely. For example, the user when connected enters just the number of the channel he wishes to check: the control system transmits a distinctive tone (e.g. the interrupted tone) if it is switched on: preferably the system now requires # to be entered to maintain the "on" status of the channel, or \* to switch it off. Preferably the system requires either # or \* to be entered within the allowed time period, otherwise the system maintains the same channel status as before it was called. Preferably the system also responds to a command to switch all channels off simultaneously, e.g. 0\*.

Preferably the time period allowed by the system to effect control functions is adjustable. Preferably just before the system times out, it gives a warning tone: preferably in the short time remaining the user may extend or reset the

allowed time period by keying an appropriate code (e.g. 9#), but preferably this is only possible after the security code has been correctly received. In a similar manner, preferably the control system can be switched off line deliberately by entering an appropriate code e.g. 9\*.

Preferably the control system enables the security code to be selected and written into the system by the user, first by selecting security write mode then entering the desired security code using the local keypad. In a preferred embodiment for example, # is entered to reset a counter to zero, then a push button is pressed, then the e.g. four digit security code is entered. Preferably an LED lights during entry of the security code and is extinguished by the control system after entry of the last digit.

In local mode operation, preferably the security lock-out is bypassed and any switching function is achieved by keying the appropriate channel-select and on/off codes as in remote mode, Channel status is preferably indicated by LEDs on the control panel.

Preferably the control system incorporates a reserve power supply which retains the security code and the on/off status of the controlled appliances in the event of mains power failure. Preferably in remote mode operation the control system will not respond to a telephone call during mains power failure and will revert to intended operation with security code and channel status unaffected when mains power supply is restored.

An embodiment of this invention will now be described by way of example only and with reference to the accompanying drawing which is a schematic block diagram of a control system in accordance with this invention.

Referring to the drawing, there is shown a control system installed in a house and arranged for controlling electrical appliances either remotely over the public telephone system or locally. The system is connected into the telephone

system in place of or in parallel with a normal telephone or answerphone. In use, if a caller rings in over the public telephone network from a remote location whilst the system is switched to remote mode, a ring detect circuit 10 detects this and initiates a timer 12 via an opto-isolator 11. After a predetermined time period set by timer 12, relay contacts RL1 are closed to enable the system to receive and transmit tones via a line interface 25.

The system includes a driver 13 and a tone generator 15 which transmits various tones at different times but which also transmits a short tone when the system picks up at RL1 and just before the timer 12 times out. The system includes a decoder 14 to receive and decode tones either transmitted to it over the public telephone system (e.g. from a hand held unit 28) or passed to it by a local tone generator 15 under control of a keypad 16 of the system control panel. Once it has picked up, the system requires the user (if remote) to transmit a predetermined security code and this is decoded at 14 and checked at 17: if it is correct, the tone generator 15 transmits an acknowledgement tone.

Once the security code has been approved, security decoder 17 enables a further decoder 18 to decode subsequently transmitted tones and control a logic circuit 19 which controls the tone generator 15 to send back appropriate acknowledgement etc, codes. Logic circuit 19 also controls output relays e.g. 20 for different channels via respective buffers 21 and opto-isolators 22. Instead of or additionally output relays 20 may be controlled via encoded transmission 26 and encoded reception 27 using mains wiring or radio frequencies as transmission medium. The relays 20 control on/off switches 23 for the respective channels, to switch on or off electrical appliances or power supplies controlled thereby. LEDs 24 are provided in the control panel for each channel to indicate its status and an LED 29 is also provided in the control panel to indicate whether the system is in local or

remote mode. A switch 30 on the control panel is manually operable to select local or remote mode: when in remote mode the system can only be operated by calling in from a remote telephone, whilst when in local mode the system can only be operated from the keypad 16 and will not pick up or respond to any incoming call.



CLAIMS

1. A control system for controlling one or more electrical appliances, comprising means for connection to a telephone line and arranged to respond when the appropriate telephone number is called, and control means for then responding to audio tones received over the telephone line to control the electrical appliances remotely, the control means also being responsive to audio tones generated by use of a keypad of the control system to control the electrical appliances locally.
2. A control system as claimed in claim 1, arranged to detect a security code received over the telephone line before enabling the system to respond to said audio tones to control said appliances.
3. A control system as claimed in claim 2, arranged to verify receipt of a correct security code by transmitting an acknowledgement tone over the telephone line.
4. A control system as claimed in claim 2 or 3, arranged to disconnect from the telephone line if a correct security code is not received within a predetermined period.
5. A control system as claimed in any one of claims 2 to 4, arranged to disconnect from the telephone line if no audio tones are received from the caller in a predetermined time after detecting a correct security code.
6. A control system as claimed in any one of claims 2 to 5, arranged to transmit an acknowledgement tone in response to each audio tone received over the telephone line after detecting a correct security code.

7. A control system as claimed in any preceding claim, arranged so that the status of any appliance control channel of the system may be remotely determined.

8. A control system as claimed in claim 7, arranged to transmit a distinctive tone, indicating that a selected channel is on (if it is on), upon receipt of an audio tone selecting that channel.

9. A control system as claimed in any one of claims 2 to 8, which responds to reception of a predetermined tone, after detecting a correct security code, to extend a period during which the system will respond to said audio tones.

10. A control system as claimed in any one of claims 2 to 9, which responds to reception of a predetermined tone after detecting a correct security code, to disconnect from the telephone line.

11. A control system as claimed in any one of claims 2 to 10, in which the security code can only be altered locally.

12. A control system as claimed in any preceding claim, arranged to switch an appliance on or off in response to a said audio tone to select its channel and an appropriate on or off function code.

13. A control system as claimed in claim 12, arranged to switch off all channels simultaneously in response to a predetermined said audio tone.

14. A control system as claimed in any preceding claim, further comprising a manual switch for switching the system from remote to local mode operation and vice-versa.

15. A control system as claimed in claim 14, further comprising a visual indication of remote or local status.

16. A control system as claimed in claim 14 or 15, arranged to bypass the requirement for the security code when in local mode.

17. A control system as claimed in any preceding claim, arranged to transmit a predetermined tone when the system picks up in response to a call over the telephone line.

18. A control system as claimed in any preceding claim arranged to respond to said audio tones when of dual tone multi frequency (DTMF) type.

19. A control system as claimed in any preceding claim, in which the time before the system picks up in response to a call over the telephone line can be adjusted.

20. A control system as claimed in any preceding claim, which further includes on/off switches for controlling said electrical appliances.

21. A control system substantially as herein described with reference to the accompanying drawing.

22. A control system as claimed in any preceding claim, when connected in parallel with another telephone apparatus, e.g. a telephone answering machine.

23. A control system as claimed in any preceding claim, further comprising a separate tone generator unit for generating audio tone for transmission to the control system from a remote location over the telephone network.

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